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Title: Sol-Gel Processing of  $\text{Li}_5\text{La}_3\text{Ta}_2\text{O}_{12}$  for Transparent Ceramic Scintillators

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# Sol-Gel Processing of $\text{Li}_5\text{La}_3\text{Ta}_2\text{O}_{12}$ for Transparent Ceramic Scintillators

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# Summer Fun



# Josh Smith (Sigma)

- Educational Background
  - BS in Nuclear Engineering Texas A&M University, 2016
  - MS/PhD student. The University of Tennessee Knoxville, 2021
- Sigma
  - Powder Materials Processing
  - Chris Chen
- Research
  - Sol-Gel Processing of  $\text{Li}_5\text{La}_3\text{Ta}_2\text{O}_{12}$  for Transparent Ceramic Scintillators
  - Synthesis and Characterization of Ceramic Scintillators



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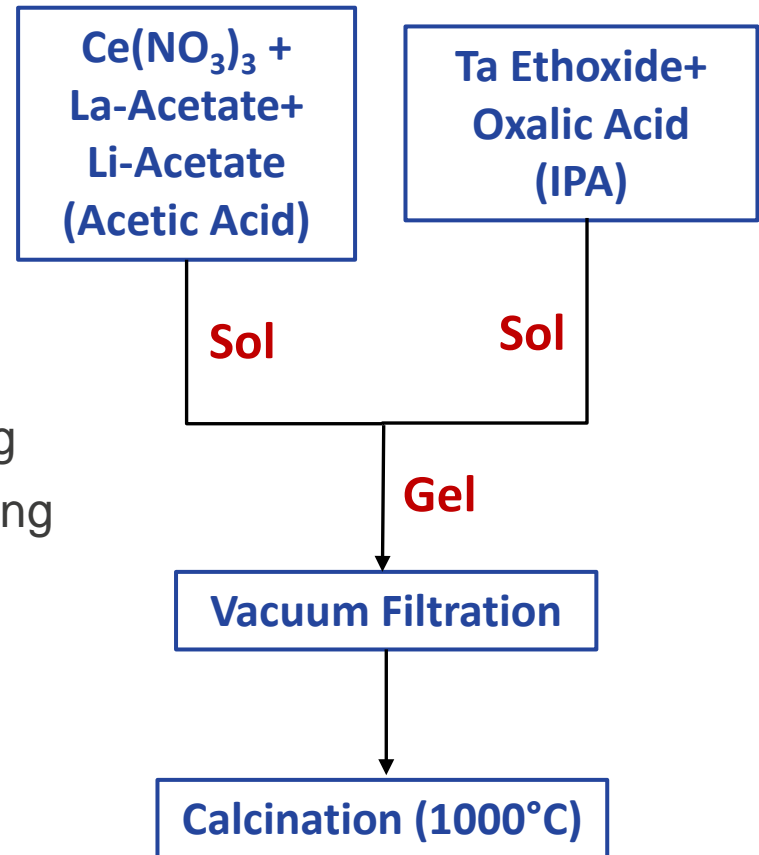


# Research Overview and Motivation

- **Scintillators for Radiation Detection for Nuclear Security Applications**
- **Ceramic Scintillators**
  - Alternative to single crystal growth
- **$\text{Li}_5\text{La}_3\text{Ta}_2\text{O}_{12}$** 
  - Dual purpose detection material (n and  $\gamma$ )
  - $\text{Li}^6(\text{n}, \alpha)\text{H}^3$  – Pulse Shape Discrimination
- **Nano-particles**
  - Lower sintering temperatures
  - Decreased residual pore size, increased transmission
- **Sol-Gel Method**
  - High-purity, flexible composition possible
  - Scalable production method

# Research Approach

- **Nano-particle Synthesis**
  - Produced via Sol-Gel process
  - Characterized using XRD and SEM
- **Ceramic Synthesis**
  - Closed porosity achieved by hot pressing
  - Final densification by hot-isostatic pressing
  - Characterize by XRD and SEM



# Summary of Results

## • Nano-particle Synthesis

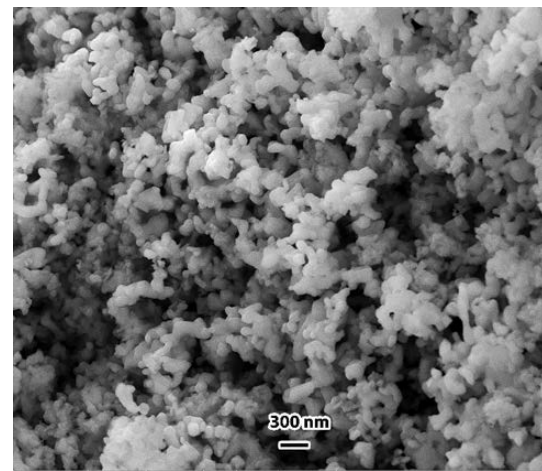
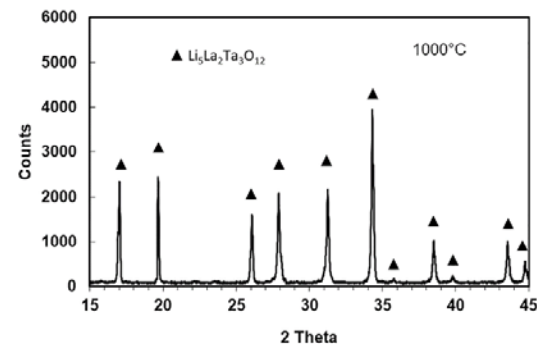
- XRD confirmed cubic  $\text{Li}_5\text{La}_3\text{Ta}_2\text{O}_{12}$  belonging to space group  $Ia\bar{3}d$
- SEM showed agglomerated particles with an average size of  $\sim 150$  nm

## • Ceramic Synthesis

- Hot pressing in progress
- Hot isostatic pressing will be completed after

## • Other Compositions

- $\text{BaF}_2$



$\text{Li}_5\text{La}_3\text{Ta}_2\text{O}_{12}$   $\sim 150$  nm